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celeration and retardation of certain parts of the animal, during its growth, and Professor Hyatt previously* showed that the development of the individual Cephalopod is an epitome of the development of the cephalopods generally, and that the successive forms were produced with comparative suddenness.

Previous to the appearance of Mivart's work in this country the reviewer, in the present journal (vol. iv, p. 755), while remarking on the ancestry of the King Crab, Trilobites and other Branchiopoda, accounted for their origin rather by a process of acceleration and retardation, involving a more or less sudden formation of generic forms, than by the theory of Natural Selection, and offered several of the objections against Darwinism which appear in the work under review. The former law, probably in active operation during the earlier portion of embryonic life, accounts for the origin of the differences, while Mr. Darwin simply assumes an inherent tendency to variation. Cope's law may account for the *origin* of the new forms, while Natural Selection apparently plays an entirely subordinate role, and even may be found to account merely for the *preservation* (as suggested by the Duke of Argyll) of the specific form, keeping it within limits by the survival of the fittest, and the lopping off of monstrosities and by the checking of all tendencies to variation in a useless direction.

MEDICAL MICROSCOPY.† — Dr. Richardson's book is an experiment in an absolutely unoccupied field. Other works of somewhat similar nature are books for microscopists who are physicians; this is a book for physicians who are not microscopists. Meagre in its account of apparatus and inaccurate in its scholarship as it must be confessed to be, it is an earnest, straightforward and successful attempt to enable the practicing physician to make the microscope useful in his daily work. Some who use it for this purpose will be disappointed, for successful microscopical work requires a delicate tact and a mechanical ingenuity which are possessed by very few persons, and which are wanting to many even among physicians. Good microscopists, too, are developed, not made;

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* Parallelism between the order and individual in the Tetrabranchiate Cephalopods. Memoirs of the Boston Society of Natural History, 1866, and AMERICAN NATURALIST. Vol. IV, pp. 230 and 419.

† A Hand-Book of Medical Microscopy. By Joseph G. Richardson, M. D., Microscopist to the Pennsylvania Hospital. 12mo, pp. 333. Philadelphia: J. B. Lippincott & Co., 1871. [This review was prepared for a previous number, but its appearance was accidentally delayed. — EDS.]

and a high success can rarely be attained except by those whose dexterity and skill in effecting mechanical and optical results have been matured by long use before the exigencies of a full medical practice rendered abundant drilling in the work impossible. For these reasons, Medical Microscopy will always remain to some extent a specialty, most conveniently referred to the few physicians more particularly devoted to it. But for the microscopical work which physicians, as such, can do to advantage, for the using of the microscope, like the stethoscope and the test-tube, as an every-day aid to diagnosis, a really available guide book is now for the first time published. For the general reader it is too technical and uninteresting to be compared with other works that are available; to the scientific physician it is a valuable aid.

Students of this book should begin in the middle of it; reading the first part last, if at all. Nothing less than the author's excellent success as a microscopist could save a beginner who had waded through the opening chapters from abandoning the work in confusion and disappointment. The first two chapters are devoted to a description of instruments, apparatus, etc., and it is astonishing that so good a microscopist could be so bad a critic in regard to his own tools. Aside from the tediousness and general confusion prevailing in this part of the work there is much that is liable, unless corrected, to seriously mislead the beginner.

The simple microscope is described as one of a single lens; and the compound microscope, by way of contrast, as one in which lenses are so arranged that each adds to the power of the other. This is precisely what occurs when a doublet or a triple combination is used as a simple microscope, and is radically different from the action of the compound microscope where one lens, or set of lenses, by magnifying the image formed by the other, *multiplies* its power instead of *adding* to it.

Three or four of the microscopes first mentioned are described as furnished with sets of separating objectives like those on cheap European instruments, and these lenses are spoken of with some approval, although it would be more safe to state that to render such instruments really available it is necessary to discard such objectives and furnish at least second-class lenses by some respectable maker. The objectives of Tolles' students' microscopes are very properly called by their honest name, for they are *second-quality* lenses and nothing else, but it should have been intimated for the information of beginners that the lenses previously mentioned are, by the same accepted standard, far less than second quality. The one-inch lenses furnished lately with Tolles' students' microscopes have been too cheap to be good; but his second-quality one-fourth, one-sixth, etc. (which are most used by physicians), as well as similar powers by Zentmayer, Grunow, etc., are incomparably better than the cheap lenses, often called triplets, mentioned above.

It is stated that the higher objectives are each composed of three pairs of lenses or doublets, properly arranged; although it is understood by microscopists that the posterior combination is often a triplet, and that the anterior pair is often replaced by a triplet or by a single lens.

In regard to the qualities of the objective there is an unfortunate want of clearness and sharpness in the author's use of terms; penetrating power being used sometimes in reference to that resolving power which is the joint result of definition and angular aperture, and sometimes as descriptive of that depth of field to which its use seems to be generally and usefully confined.

But the most astounding assertion in regard to objectives is this, that the lenses of various opticians are almost equally successful up to powers as high as one-eighth inch! If those opticians, whose names are familiar words, have achieved eminence anywhere it has been in the *excellence* of their low and medium powers. Tolles' most remarkable lenses are probably from one-fourth to one-eighth inch focus; and Wales' four-tenths (one-fourths?) and one-fifths are nearly equally famous powers. Ross's lenses, of which none are of very high power, have enjoyed a conceded preëminence; Smith and Beck's four-tenths has been classical for years, while their high power, one-twentieth, has been of very moderate use; and Powell and Lealand's one-eighth and one-sixteenth have doubtless contributed more renown than their one-twenty-fifth and one-fiftieth. And it is probably safe to predict, as the opinion of most microscopists, that the progress of the near future belongs to those opticians who shall use the most extraordinary skill in perfecting and utilizing lenses of moderate focal length.

The subject of test-objects is treated at some length for the avowed benefit of such students as might find it difficult to secure the assistance of an expert in selecting their lenses. Doubtless it would have been safer to advise the student in such cases to trust entirely to the honesty of a responsible dealer or to the respectability of the maker of the lenses required. The "testing" of first-class lenses, by a person unfamiliar with their use, is simply a delusion.

The binocular microscope certainly merits more than the half page of careless notice given to it. Although its chief use, as yet, is in other departments of study, yet its real value to the physician is not even hinted by the passage referred to. Wenham's binocular, the one in actual use, is almost indispensable in studying opaque injections, vegetable and animal parasites, etc. At the Troy meeting of the American Association last August, the writer showed specimens of animal and vegetable tissues (such as transparent injections, etc.) under this arrangement with good definition, an even light over both fields, and the stereoscopic effect vivid and useful though perhaps somewhat exaggerated, under the ordinary first-class objectives as high as one-fifth inch focus, and up to 120° ang. ap. Probably, however, satisfactory substitutes for Mr. Wenham's arrangement will be in general use for all powers above one-half inch at no distant day.

In giving directions for estimating the magnifying powers, and the amplification of camera-drawings of objects, the author follows respectable authorities into an error of grave practical consequence. To measure the magnified image at the exact distance of the object is plausibly borrowed from the usage of the telescope where the object is at a fixed distance — its apparent size being always its angular extent at that distance, and the image being measured by the object itself, of course at the same distance. But the microscopic object is at no necessary and invariable distance from the eye, and its apparent size, *i. e.*, its angular extent, varies with that distance, and is with no more propriety used as a standard at the distance of the stage, than at any other distance. Would any person measure the image in a simple microscope at the exact distance of the object on the stage? or if, for any purpose, a compound microscope six feet long were constructed, would its image be measured according to the same rule? Or, of two dissimilar microscopes containing similar objects, say Maltwood finders, the stages being concealed so as to be at an unknown distance, would any microscopist hesitate an instant before deciding which instrument magnified the most, such decision depending, of course, on the certainty with which the magnifying power of each could be determined without the least knowledge of the position of its stage? The fact that the apparent size of the object or image is simply a question of angle, and that, if expressed in linear measure, that measure must be taken at a uniform distance for all observations liable to be compared with each other, — in other words, that to use sines and cosines intelligently it is indispensable to assume a uniform radius — would seem to be too simple for argument, were it not that a misunderstanding in regard to it is a common and confusing error. Ten inches having been generally adopted as the standard distance of measurement in microscopy, and being at the same time a most convenient distance, there seems to be no reason for reconsidering the choice; or, for assimilation to the metric system, 250 millimetres might be substituted without any considerable error.

Of the minor errors and inadvertencies in this part of the book, may be mentioned the following: — The use, as a condenser in students' microscopes, of the concave mirror transferred to a separate stand (it may often be mounted on the stage for the same purpose), is mentioned, but without the special commendation which it deserves. It is not stated that Tolles' students' microscope can be obtained with the usual form of fine adjustment which is to be preferred to the "new method" mentioned; nor that "the fine adjustment on the stage" of some of the same instruments, and of those prepared by some other makers at the present day, is so firm as to be reasonably satisfactory, while similarly situated adjustments on a lighter class of instruments are usually so insecure as to be entirely worthless. Following the lead of some of the dealers, the fine-adjustment screw is called a "micrometer screw," an unfortunate phraseology which, to the writer's knowledge, has often proved confusing to students. Powell and Lealand's splendid No. 1 microscope is mentioned as the *ne plus ultra* of instruments, whereas it is only fair to admit that the choice between such instruments as this (including Ross' large stands, etc.) and the best stands of the "Jackson" model, is a fair field for the use of taste and judgment, neither form enjoying a conceded and unqualified superiority. Most eye-pieces are said to be composed of achromatic lenses, a mistake which is liable to mislead beginners. The student is advised, under some circumstances, to increase his power by removing the field-lens of his eye-piece, a worse than questionable procedure; nor is he reminded to blacken the inside of the pasteboard draw-tube recommended for the same purpose. Wenham's binocular arrangement, notoriously consisting of a single prism, is mentioned as an arrangement of prisms. The use of unground glass slips is mentioned with indifference, though the student should never use them, unless they are to be covered with paper, without rubbing off the cutting edges on a grind-stone or on any wet piece of soft sandstone. As a convenient substitute for the mounted needles whose preparation is directed by the author, crochet needles may be bought of suitable size and style, deprived of their hooked ends and sharpened on an oil-stone or hone; or the form may be purchased in which the needle is removable and easily replaced by a common needle, being clamped into the handle by a screw-movement. Likewise the conical glasses, scratched with a file, for estimating the bulk of sediments, may be replaced by 4 oz. graduated measuring glasses, which, sold by the dealers in druggists' glassware, can often be obtained of exactly the desired shape. "Healthy blood," on page 39, should read healthy human blood. Such objects as the "various species of acari" should not be mounted in the dry way, much less received as typical of a class of specimens peculiarly adapted for such preparation; nor should a book of the present day reproduce from the old authorities the abominable direction to place a dry object upon the slide and protect it by a cover carefully laid upon it and fastened down by gummed paper. Glycerine is, perhaps wisely, recommended to the beginner in mounting wet specimens, although a more difficult medium to manage than Farrant's Gum and Glycerine or Walmsley's Glycerine Jelly.

The use of blue glass (spectacles, etc.) is casually noticed as a means of correcting the yellow glare of artificial light; but the position of the blue glass is not so unimportant a consideration as would reasonably be inferred from the text; in the writer's experience the best results are obtained by a flat piece of glass lying upon the diaphragm or below the achromatic condenser; a curved plate (deep-blue chimney) near the flame, or flat plate in the cone of light over the achromatic condenser, or over the eye-piece, being much less satisfactory: a very pale-blue chimney, just tinted, may be used to take off the glare without whitening the light; and the white, translucent "porcelain" chimneys, recently introduced, may, if quite thin, often be used to advantage. The author, in his enthusiasm for high powers, scarcely urges with sufficient distinctness that the beginner should confine himself to low powers, not over one-fourth, until great skill has been obtained by long practice. He advises that high-power lenses be sent "to an optician" for cleaning, etc., instead of saying that they should be sent to the maker, or at least to a person accustomed to make the same class of work: imagine a Ross' one-twelfth or a Tolles' one-tenth sent to a local "optician" for repairs! Dr. Beale's directions for adjustment of objectives by measuring the covering glass by the screw-collar movement, are given without an intimation that good performance by lenses made at the present time cannot be obtained in this way. The amplifier is named as a means of increasing power, but without the caution that some of the cheaper kinds sold are not achromatic and are perfectly worthless. Polarized light is mentioned, on authority of an obsolete remark by Dr. Beale, as an expedient of equivocal value; whereas the medical expert finds it of great use in detection of poisons and adulterations, and in some other investigations; and the polarizing apparatus is too carelessly described as consisting of two crystals of Iceland spar. The micro-spectroscope is properly mentioned as a promising means of research, and appreciative mention is made of recent work in photographing microscopic objects. Finally, the list of microscope makers and dealers is rather less than satisfactory.

In regard to the main body of the book, relating to the practical work of the microscope in medicine but little need be said. A single expression of unqualified approval will apply to nearly all of it. With fewer inaccuracies than usually fall to the lot of first editions, such as speaking of ether as "sulphuric ether," mentioning "fibres of flax from — muslin fabric" etc., an excellent and available summary is given of the subjects treated; adequate study being devoted to the literature of the science, and important additions being contributed from the author's experience. The identity of the white blood corpuscles with the similar bodies of mucus, pus, and saliva, more fully and fairly maintained than by any previous authority, is not a theoretical, but a practical question; as students have been for years past perplexed and retarded by their hopeless efforts to distinguish between these bodies, while most microscopists of experience were ready to express themselves unfamiliar with any available distinction. The equally practical questions of the early detection of phthisis, and the detection of blood discs in dried stains, are relieved of much of their former obscurity and doubt, and the study of morbid growths is exceedingly well simplified and systematized. Cautious microscopists would probably fail to go as far as the author in the recognition of the discs of human blood, as distinguished from those of *some* of the domestic animals, since differences so minute, so subject to variation, and so liable to mismeasurement on account of slight differences of illumination, adjustment of lenses, etc., are justly deemed untrustworthy in cases involving important interests; but, taken with some allowance for the author's enthusiasm, the treatment of the subject is eminently useful as well as novel and interesting.

The almost total absence of engravings is the first feature which attracts attention on opening the book. This, in the chapters which treat of instruments and apparatus, is a sign of maturity, not of poverty. The works of Carpenter and of Beale, first issued at a time when illustrations of stands and accessories were indispensable, very properly retain these illustrations and add to them according to the progress of the times, in order that they may continue to be encyclopædic to all microscopical students of English-speaking countries; but the time has passed, when new works need encumber themselves with such pictures. Stands and lenses and prisms are sufficiently familiar to all except beginners who may well be referred to the elaborate, and often excellent catalogues of the opticians. Beck's catalogue, for instance, studied in connection with two or three others to suggest an idea of the individual differences in the style of different makers, would give a better conception of the various kinds and classes of apparatus than all the illustrations which could reasonably be crowded into a Hand-book of Microscopy. In regard to the latter part of the book, however, the paucity of engravings is an evident fault. The exact appearances of diseased tissues, morbid growths, and abnormal deposits, are not yet completely familiar to the mass of physicians and medical students: if they were, then this book would occupy a crowded, not an open field. In his ambition to reduce the illustrations nearly to a standard of original contributions, the author has strained a point which will probably be yielded in later editions by the introduction of a liberal assortment of wood-cuts, which will relieve the student of the necessity of searching the literature of his profession for exactly the light which this volume is designed to give.

On the whole, the faults of this volume are mostly those of hasty preparation or of the occupancy of an unfamiliar field — errors which a second edition, sure to be wanted, will easily correct; while its advantages are so manifest that it cannot fail of an extensive usefulness. — R. H. W.

Recent Ornithological Publications. — With the close of the year we have two papers of interest. Dr. H. M. Bannister, whose name is associated with the late explorations in Alaska, offers* "A Sketch of the Classification of the American Anserinæ," which renders our information more precise, if not more extended. Excluding the genera Dendrocygna and Chenalopex, he divides the Geese proper into two sections, *Ansereæ* and *Philacteæ*. The former of these includes the two typical genera, *Anser* and *Branta*,† in which the sexes are alike, and the plumage nowhere metallic; and three sub-typical genera, all South American, viz.: *Oressochen*, n. g., *Chlœtrophus*, n. g., and *Chlœphaga* Eyt., in which either the sexes are dissimilar, or else the plumage has iridescent tints. The Philacteæ are marked by the presence "of deep rough superorbital depressions, and reversed relative proportions of tarsus and middle toe [the former shorter or not longer than the latter], together with an exclusively sea-coast habitat, and a carnivorous diet, corresponding in some of these respects with the Oidemiæ and Somateriæ among ducks" (p. 130). This section embraces one North American species usually called *Chlœphaga canagica*, here made the type of *Philacte*, n. g.; and the South American *Tœnidiestes antarctica*. Of the naturalness of this arrangement, as well as of its convenience, there is probably no doubt, and though division *genericè* may seem pushed to an extreme, yet this conforms to the usage of the day; the only question is, whether corresponding subtilty would not demand the recognition of Chen, and even Exanthemops, as distinct from Anser. We regret that the paper is defaced by too numerous and inexcusable typographical errors, for which, however, we happen to know that the author is not responsible.

In the list of North American species we notice the absence of *Anser albatus* and *Branta leucopareia;* the former, if only indeed a small race of *A. hyperboreus*, we should judge entitled to recognition; but the latter has doubtless no such claims; nor should

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*Proc. Acad. Nat. Sci., Philada., Sept.-Dec., 1870, p. 130.

†Scopoli, 1769, ex Klein, type *A. bernicla* L.; nec Boié, 1822, type *Anas rufina* Pall.; thus equal to, and antedating, *Bernicla* Boié, 1822.